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Making the Learning Sciences Count**
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ORBIT - Overcoming Breakdowns in Teams With Interactive Tabletops

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Abstract: ORBIT implements and studies a joint problem-solving activity at a tabletop tangible user interface (TUI) providing participants with the opportunity to develop their collaboration methods through jointly overcoming breakdowns. The design and the research process relies on user-centered design methods and on an ethnomethodological conversation analytic framework. The project will both generate scientific knowledge on participants' collaboration methods and create a powerful TUI-mediated collaborative learning tool.

Introduction

There is an increasing recognition that future societal and intellectual challenges can only be solved collaboratively (Stahl, 2010). However, constructive collaboration on new challenges is a difficult matter and the mere joining of people's forces does not help unless people know *how* to collaborate (Schwarz et al., 2015). Hence, learning to learn and to work together must become an important goal in education and professional training. So, the design research project ORBIT aims at implementing and studying a joint problem-solving (JPS) activity mediated by a tangible user interface (TUI). The main objective of the project is to implement and study a TUI-mediated JPS activity that gives adult participants the opportunity to deal with and overcome breakdowns through collaboration (by that way learning to collaborate). Accordingly, the following research questions will be addressed: (1) How to design a TUI-mediated joint problem-solving activity eliciting participants' collaboration to overcome breakdowns? (2) How do the participants cope with and overcome breakdowns in a TUI-mediated joint problem-solving activity through collaboration?

Methodological framework

Having both analytic and design components that are closely interwoven, the current project adopts a design-based research approach (DBR) (Reimann, 2011). Koschmann et al. (2007) point to the need for conducting fine-grained video-analytic studies of instructional practice to address the issue of how to account for the functioning of the design in authentic settings and to have at their disposal an appropriate method to "document and connect processes of enactment to outcomes of interest". They advocate for the implementation of an approach that relies on ethnomethodology (Garfinkel, 1967) and conversation analysis (Sacks et al., 1974) to systematically and rigorously study practice. In the meantime, many CA investigations go beyond talk and also take into account gestures, gaze, body postures and movements, and spatial and material resources mobilized by the participants. Additionally, the TUI developments in the DBR process will turn to user centered design (UCD) methods (e.g., prototyping, multi-disciplinary design workshops, walkthroughs) which give attention to the needs of the end-users. CA and UCD are "rooted in a shared methodological credo. To understand human interaction and the use of technologies, CA rigorously examines the participants' perspective" and UCD takes "as point of departure how the users interact with technologies" (Egbert, 2001, 208).

Study design

The ORBIT problem-solving activity will be implemented in two different settings: with in-service teachers during of a workshop on "collaboration", and with municipal staff members in the context of their trainings on soft skills and diversity. The TUI-activity will be based on a rule induction problem whose difficulty will increase as the participants progress. In a first phase, participants will, for example, have to discover how to steer an unknown vehicle demanding them to simultaneously operate several control devices (materialized by widgets). The process of mastering the steering of the vehicle will provide participants with a shared experience of successful joint problem solving. In the subsequent phase the difficulty of the problem is increased by implementing software-generated breaches in order to generate breakdowns (1) which have to be overcome by the participants to complete the task successfully. More precisely, the breaches will be designed either as "information gaps" or as "procedural mismatches". The former distribute essential information unevenly among the participants thus creating an asymmetry of knowledge, while the latter change the rules of the underlying system. Coping successfully with the dynamics of the designed problem requires the participants to rely on multiple resources, create a joint focus, work interdependently, exchange ideas and information, and co-

construct a shared understanding. However, the research team is aware that “intended pedagogical aims and ideas” (task-as-workplan) do not necessarily “translate directly” into actual problem-solving practice, and so the main focus “will be on what actually happens, that is the task-in-process” (Seedhouse, 2004, 93, 95), which is reflected in our EM/CA approach. The design process will use seven iterations (two walkthroughs and five trials), which progressively deal with a different focus and related sub-activities of the JPS activity (see Figure 1). The five trials will be video-recorded from different angles and perspectives (see Arend et al., 2014) generating approximately fifteen hours of video data. The latter will be searched to identify relevant sequences (accounts of collaboration, accounts of breakdown) and the findings will feed back into the design process.

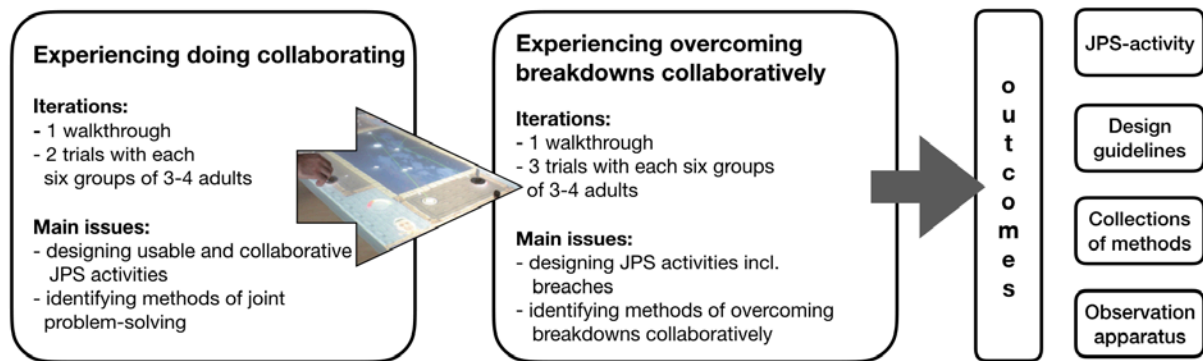


Figure 1. Synoptic plan of ORBIT.

Expected outcomes

The project will result in the design of a TUI mediated JPS activity of high usability and integrating series of breaching moments with the aim of supporting learning to collaborate. In this vein, it will develop and refine design guidelines to support the design of TUI-mediated JPS activities. Furthermore, ORBIT will contribute to the construction of a theoretical and methodological framework regarding the analysis of collaboration processes and methods to overcome breakdowns in a digitally mediated environment. More precisely, it will create collections of participants’ accounts of breakdowns, of participants’ methods of overcoming breakdowns, and of participants’ methods of doing collaborative work; and contribute to the creation of a methodological and technical apparatus for instantiating and researching JPS activities.

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Acknowledgments

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